

ALUMINUM

Project Fact Sheet



INNOVATIVE VERTICAL FLOATATION MELTER (VFM) AND SCRAP DRYER

BENEFITS

- Fuel savings of up to 80 percent with the combined use of the VFM with an indirect-fired controlled-atmosphere rotating kiln (IDEX™)--which de-coats and dries scrap with practically no energy input
- Energy savings in the U.S. of 22 trillion British thermal units (Btu) annually
- Reduction in dross, which translates into a savings of 125,000 tons of aluminum each year (based on 2.5 million tons of secondary aluminum production and a five percent reduction in oxide formation)
- Reduction in NO_x , SO_x , CO, and volatile organic compound (VOC) emissions associated with secondary aluminum melting
- Reduction in oil and other organics from scrap utilized as supplementary fuels for the VFM

APPLICATIONS

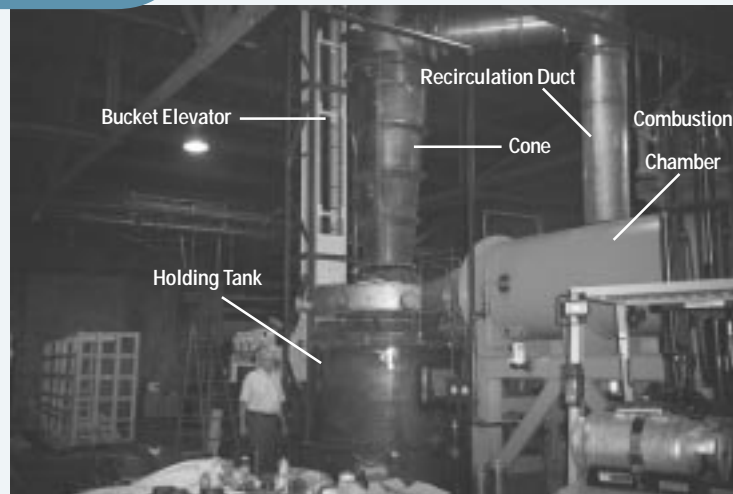
Advantages of VFM are its ability to handle a wide variety of scrap shapes and sizes, and perform faster melting, as opposed to the existing side-well reverberatory furnaces and electric (induction) melters used in the aluminum industry.

VFM WILL PROVIDE A SIGNIFICANTLY CLEANER AND MORE EFFICIENT ALTERNATIVE FOR PROCESSING SCRAP

Recycling is a critical component of the U.S. aluminum industry, from both environmental and economic perspectives. The low-energy costs associated with recycling, combined with growing concerns over solid waste disposal, have contributed to the substantial growth of this industry. In addition to saving up to 95 percent of the energy needed to manufacture primary aluminum, recycled aluminum conserves natural resources, lowers emissions of hydrogen fluoride, carbon dioxide, sulfur dioxide, nitrogen oxide, and carbon fluoride, and reduces the generation of waste materials. The amount of recycled aluminum doubled in the last 10 years, growing over one-third of the total U.S. aluminum supply, a figure that will increase as more aluminum is used in transportation applications.

Recycled aluminum is typically melted in gas- or oil-fired reverberatory furnaces, which generate substantial emissions. The VFM will be an energy-efficient, environmentally-friendly, advanced remelting process, which will help the aluminum industry meet energy and environmental performance targets set in the *Aluminum Industry Technology Roadmap*. The Semifabricated Products Sector performance targets--to improve fuel efficiency in melting and holding furnaces and reduce emissions--are also supported by the *Innovative Vertical Floatation Melter* project. An enhanced remelting process will increase the recyclability of scrap, thus, increasing the use of recycled aluminum as the primary source of aluminum products for manufacturing, which will in turn decrease the national need for additional smelting capacity.

PHOTOGRAPH OF THE VFM



The VFM represents an advanced remelting process for recycled aluminum.



Project Description

Goal: Develop a significantly cleaner and more efficient alternative for processing aluminum scrap, that also results in an increase in metal yield.

In the integrated process, the scrap will be first dried and de-coated in an advanced de-coater, termed IDEX™, which completely removes organics, such as oil, paint, and plastics. The heat content of the organics volatilizing from the scrap supplies the heat needed to operate the de-coater. Next, the scrap aluminum is melted in the VFM.

The thermal efficiency of the integrated process is expected to be over 75 percent, compared to the conventional furnace at 19 percent. The emissions of NO_x, SO_x, CO, and VOCs from the process have been measured to be well below the regulated allowable limits. The process will also result in an increase in revenue for the secondary aluminum industry by over \$400 million per year.

In the VFM, the dried and de-coated scrap will then be melted, where particles of varying sizes and surface areas are aerodynamically suspended at different levels of the melter. While the scrap is suspended, the gas velocity is equal to the scrap's terminal velocity resulting in very high convective heat transfer coefficients. The scrap is suspended for 15 to 30 seconds, allowing sufficient residence time for it to melt. Once melted, the scrap takes on a teardrop shape and immediately falls out of the VFM cone and into a holding chamber. Due to the low gas temperatures required and short residence times, dross formation is minimized resulting in very high metal yields.

This process also has applications in the glass and steel industries.

Progress and Milestones

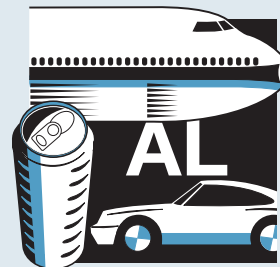
In the first phase of the project, the VFM process was designed based on experimental measurements, calculations, and issues determined from industry partners. Measurements of heat transfer coefficients, drag coefficients, and chemical reactions in the presence of water vapor and oxygen were used for an efficient process design. The efficiency of VFM is estimated to be 57 percent, rising to 75 percent when integrated with the IDEX™.

In the second phase, a pilot-scale VFM was designed and constructed. Tests on this system are being conducted at an Energy Research Company (ERCo) facility in Syracuse, NY, using used beverage cans (UBC) that were shredded, cleaned, and supplied by Wabash Alloys, L.L.C. (formally Roth Brothers). The scrap is melted using a gas temperature of 1,600 degrees Fahrenheit in approximately 30 seconds. Pilot scale tests have been completed.

In the third phase, the VFM will be tested at a host site.

Commercialization Plan

ERCo will be responsible for engineering design and support. O'Brien & Gere will be responsible for North America commercialization. Stein, Atkinson Stordy will commercialize the technology in Europe. Marketing responsibilities for the Far East will be negotiated.



PROJECT PARTNERS

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